

# Agro-advisory services for increasing production, profit under climate change scenario in old alluvial zone of West Bengal

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## Abstract

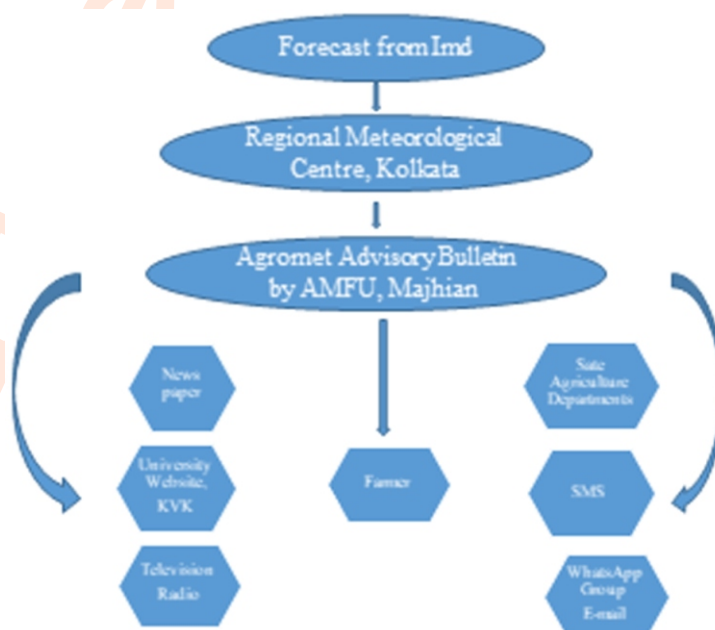
**Aim:** To increase the net income of farmers by reducing losses caused by extreme weather events and reducing the cost of cultivation using weather advisory and to popular the Agro-advisory service at the block level.

**Methodology:** Data was collected from the selected farmers by interview schedule, and the Weather forecast data was obtained from the Regional Meteorological Centre Kolkata, India Meteorological Department, Alipore biweekly i.e., every Tuesday and Friday.

**Results:** The results showed that the farmers who followed the weather based advisory were able to reduce the cultivation cost like irrigation cost, fertilizer cost, plant protection chemicals etc., than non-users of advisory in Rice and Brinjal crops. Farmers saved Rs. 1940 and Rs. 2444 per ha for rice cultivation and saved Rs. 6685 and Rs. 6688 per ha for brinjal cultivation in a single season by following advisories.

**Interpretation:** The studies showed that the application of advisory bulletin based on realized and forecasting of weather parameter is a useful tool for increasing the production and profit. The farming community who are utilizing the agro-advisory bulletin for agricultural practices, reduce the cost cultivation and increase the yield as well as profit.

**Key words:** Agro-advisory services, Climate change, Economic benefit, Weather forecast



## Introduction

Agromet Advisory Services (AAS) is defined as an extension of Agrometeorology, where crop management advice based on weather information, can be directly applied to improve and protect the livelihood of farmers (Stigter, 2011). Weather and climate play an important role in the success or failure of agriculture production (Chattopadhyay *et al.*, 2018). It has a great influence on every phase of growth and development of a crop. Any deviation in the weather phenomena from the normal weather condition during the cropping season, such as delay in the monsoon, excessive rain, droughts, floods, high temperature, etc., affect crop growth, quality of grains and productivity. These losses can be reduced by proper crop management by using time-to-time AAS and weather information. Long-range weather forecasts provide guidelines for selecting suitable crops and varieties for a particular agroclimatic condition.

On the other hand, medium-range weather forecast helps in deciding on crop management for *in situ* crops. AAS provides information to the farming community regarding the actual and expected weather and its impact on various day-to-day farming operations *i.e.*, sowing, weeding, irrigation, spraying and fertilizers application along with overall crop management. Indian Meteorological Department has been providing the AAS to the meteorological centres located in the state capitals since mid seventies. In agriculture, the lead time for taking precautionary measure is longer than one day ahead, so these one-day advance forecasts are inadequate for planning weather based practices. Later in 1991, in order to provide medium range weather forecast, ASS on medium range weather forecast was initiated in collaboration with Indian Meteorological Department, Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs), and in 1999 quantitative medium range weather based AAS was started on experimental basis with five Agro Met Field Units (AMFUs) representing five agro climatic zones of India. Beginning with five units, AMFUs were established in all 127 agro-climatic zones, by 2006, each covering few district in every agro-climatic zone (NCMRWF/DST, 1999; Maini and Basu 2016).

Weather forecast helps the farmers to take a decision and apply different agropractices to increase agriculture production and improve the quality by reducing losses caused by biotic and abiotic stress/risks and reducing the cost of cultivation by optimizing input use efficiency. National Council of Applied Economic Research (NCAER) in 2010 found that the economic advantages of these AAS at Rs. 50,000 crores per year is extrapolated to Rs. 2,11,000 crores if the whole farming community embraced the AAS in their agricultural activities (Venkatesan and Joshi, 2010). Only 24% farmers are aware of AAS, according to a research conducted by NCAER in 2015, if all farming families utilize AAS on 22 important crops, the potential net revenue gain might reach Rs. 3.3 lakh crores (Venkatesan and Munjal, 2015). The service's function is assessed in terms of its economic value and advantages to the agricultural community

will its worth, credibility, and justification for existence be recognized (Katz and Murphy, 1997). The current study was conducted in two blocks of the Dakshin Dinajpur district in West Bengal with the following goals: to evaluate the effectiveness and adaptability of block-level and district-level AAS offered by AMFU; to improve the current district-level as well as block-level Agromet Advisory Services (AAS); to deliver crop-specific and location-specific information; the block-level farmers and its economic impact to increase the income of the farming community.

## Materials and Methods

**Study area:** A study was conducted on adopting Agromet Advisory Bulletin and economic impact of Agromet advisory services for Rice and Brinjal during the year 2017-18 and 2018-19. This study was carried out at Kumarganj and Hili Block of Dakshin Dinajpur district, West Bengal. For the study, fifty farmers used Agro Advisory Services (AAS) regularly, while the other 50 farmers were non-users of AAS. The study area, Dakshin Dinajpur district lies between 25°10'55"N to 26°35'15"N latitude and 87°48'37"E to 89°00'30"E longitude. It is divided into 8 blocks: Balurghat, Bansihari, Kusmandi, Gangarampur, Hairampur, Tapan, Kumarganj and Hilli. The topography of the district is low lying, flat with gentle slopes from north to south.

In Dakshin Dinajpur district, 35,565 ha are high land, 80,260 ha are medium land, while 59,795 ha are low land. Soils of this old alluvial zone are light, medium and heavy textured low in organic matter, N, P, K and micro nutrients. It has a rural socio-economic structure, where agriculture is the primary activity of the people. The south-west monsoon brings heavy rains during the monsoon season from mid-June to September. Due to fertile alluvial soil and influence of monsoonal climate, approximately 85% of the area in the district is used for cropping activities. Cultivation of food grains like rice, wheat, maize, mustard, jute and various vegetables is carried out with the help of groundwater. Extensive cultivation of boro rice during dry season is done with the help of irrigation facilities (Sarkar, 2018).

**Data use/ requisition:** The crop related data was collected in person from farmers with the help of interview schedule. The data gathered from the selected farmers were analyzed, and the economic impact of the current study was assessed. Statistical interpretation methods were used to increase the reliability of the precipitation forecast (Damrath *et al.*, 2000). Weather forecast data on rainfall (mm), maximum and minimum temperature (°C), relative humidity (%), wind speed (kmph), wind direction (degree) and cloud cover (okta) were received five days in advance from the Regional Meteorological Centre Kolkata, India Meteorological Department, Alipore biweekly *i.e.*, on every Tuesday and Friday (Kumar *et al.* 2000; Maini *et al.*, 2004). Realized weather data of the study area were collected from the Surface Observatory and Automatic Weather Station of India Meteorological Department situated at Agro Met Field Unit (AMFU), Majhian, Uttar Banga Krishi Viswavidyalaya. Besides, Normalized Difference Vegetation

Index (NDVI) and Standardized Precipitation Index (SPI) data were procured from the Agrimet Division, IMD, Pune. Soil related information was collected from the Regional Research Station, Old Alluvial Zone, Majhian.

**Preparation of Agro Advisory Bulletin (AAB):** The weather forecast data received from RMC, Kolkata and using realized previous week weather data, the agro advisory bulletin is being prepared by the Agrometeorologist consulting with different agricultural scientists of the station. Real-time crop, livestock, etc. data from the identified blocks were being collected and AAB was prepared in both regional language (Bengali) along with English for eight blocks of the district. The weather forecast based AAB contains a summary of previous weeks' weather information, weather forecast information for the next five days, crop management, which is based on weather forecast and giving warning (like heavy rainfall, high wind speed, thunder storm, hail storm etc.) to the farmers well in advance. On the basis of the extended range weather forecast system (ERFS) on rainfall information for next two weeks, the irrigation scheduling being done by farmers and also overcome other problems like pest/disease effect. Thus farmers can decide on crop management options (like sowing, harvesting, weeding, spraying etc.) quantity and method of fertilizer application and strategies to solve the problem (Das et al., 2018).

**Dissemination mechanism:** AAB were published every Tuesday and Friday. The bulletins were directly send to farmer's mobile number through mkisan portal, WhatsApp group. The AAB was sent to the IMD for creating National Bulletin and also uploaded on the IMD web portal for vast access. Bulletins were disseminated to the Assistant Director of Agriculture (ADA) office, Krishi Vigyan Kendra (KVK), Block Development Officers (BDO) office, Police station, Collectorate building, District Agriculture Office, Disaster Management office, the farmers producers organization, Farmers Club, NGO, District Agriculture Technology Management Agency offices, Input dealers, Village-level agriculture offices and also email to the local news channel, printing media, Doordarshan Jalpaiguri and Kolkata, AIR Siliguri. Bulletins are regularly communicated to the selected block farmers on real time basis through telephone (Das et al., 2018).

**Impact study:** The objective of this study was to provide weather information timely and need based contingent crop management practices. AAB helps in increasing the economic benefit to the farming community by suggesting them the suitable management practices according to the prevailing and next five days weather conditions.

## Results and Discussion

Results showed that the farmers who followed the weather based AAS were able to reduce the cultivation cost like irrigation cost, fertilizer cost, plant protection chemicals etc., than the non-users of AAS in rice and brinjal crop. The AAS gives medium range weather forecast for the next five days that is

maximum temperature, minimum temperature, precipitation, cloud cover, relative humidity, wind speed and wind direction forecast and with their interpretation methods have a significant role for user benefits (Damrath et al., 2000). It helps the farmers to decide the suitable time for various intercultural operation and management practices like selecting best sowing and harvesting window, spraying weedicide, insecticide, giving irrigation and amount, i.e., light irrigation or moderate irrigation based on soil moisture. A perfect harvesting window can protect farmers' economic yield from extreme weather events like cyclones, heavy rain, or hail storm, and increase farmers' profits. Farmers can also lower the mortality rate of young plants due to heavy rain or agricultural drought by adjusting the sowing window. The major crops cultivated in Dakshin Dinajpur district are rice and brinjal, so this study was undertaken for these two crops only and the study was carried out at Hili Block for rice crop and at Kumarganj Block for brinjal crop. The farmers who adopted the AAS had gained more profit than non-users of AAS bulletin (Rathore et al., 2001). The farmers of Hili Block who used AAS found a reduction of 8.1% and 9.46% in the total cultivation during the Kharif season 2017 and 2018, and increased income by 10.63% in the year 2017 and 13.27% in the year 2018 and gain net profit of Rs. 6935 in the year 2017 and Rs. 8843 in the year 2018, respectively, in comparison to AAS non-user farmers for rice cultivation (Table 1; Manjusha et al., 2019; Thakur et al., 2020; Majumder et al., 2020; Mahato et al., 2022).

The farmers of Kumarganj block who followed AAS for brinjal cultivation found a reduction in the cost of cultivation by 9.35% and 10.94% in the year 2017-18 and 2018-19, and increase income by 8.69% in 2017-18 and 5.26% in 2018-19 and gain profit of Rs. 14685/- and Rs. 11688/- in the year 2017-18 and 2018-19, respectively, in comparison to farmers who did not avail AAS (Table 2). Singh et al. (2004) and Venkataraman (2004) also reported that AAS bulletin helped the farmers to reduce the cultivation cost and earn more profit due to well advance forecast of rainfall. It was observed that when light to moderate or heavy rainfall was forecasted in AAB, the AAS farmers did not irrigate the fields and in this way they saved the cost of one to two irrigation during that growing period. Farmers who used AAS found a reduction in the irrigation costs by Rs. 715 and Rs. 930 in the rice cultivation during Kharif season 2017 and 2018, while the farmers who cultivated brinjal obtained a reduction of Rs. 1225 and Rs. 1125 in the year 2017-18 and 2018-19 as compared to the farmers who did not use AAS, respectively. Similarly, in plant protection measures, the farmers who followed the AAB reported reduced costs of Rs 1050 and Rs. 1312 in the Kharif season and Rs. 2000 and Rs. 1500 in the Rabi season for rice and brinjal cultivation, respectively, in comparison to farmers who did not use AAS (Thakur et al., 2020).

It was also found that no plant protection measures were taken by the ASS farmers when there was rainfall and high wind speed forecast in ASS as high wind speed is not suitable for spraying operation. Their irrigation and spraying scheduling, proper plant protection measures and harvesting time were advised to take in the most suitable time by disseminating ASS. It

**Table 1:** Economic benefits (Rs. ha<sup>-1</sup>) of Rice cultivation as influences by AAS during Kharif season 2017 and 2018

Year	Land Preparation		Fertilizers		Seed		Irrigation		Pp Chemicals		Harvesting		Yield (ton)		Total cost		Income		Profit	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
AAS user	5250	5425	4175	4336	1200	1312.5	1470	1750	2150	2250	7500	8300	4	4.2	21745	23373.5	52000	54500	30255	31226.5
Non-AAS User	5250	5250	4350	4525	1200	1500	2185	2680	3200	3562	7500	8300	3.4	3.6	23685	25817.5	47000	48200	23315	22382.5
							715	930	1050	1312									6940	8844

**Table 2:** Economic benefits (Rs. ha<sup>-1</sup>) of Brinjal cultivation as influences by AAS during Rabi 2017-18 and 2018-19

Year	Land Preparation		Fertilizers		Seed		Irrigation		Pp Chemicals		Harvesting		Yield (ton)		Total cost		Income		Profit	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
AAS users	21500	22500	15840	18437	275	350	3200	6000	2500	4875	21500	22500	10	10	64815	54412	100000	100000	35185	45588
Non-AAS users	22000	22500	18800	22500	275	350	4425	7125	4500	6375	21500	22500	9.2	9.5	71500	61100	92000	95000	20500	33900
AAS users Benefit							1225	1125	2000	1500									14685	11688

helps the farmers to get maximum profit using less input and avoiding climate variables (Ray et al., 2017). The benefit-cost ratio (B:C ratio) for both crops was also calculated. For farmers who did not follow AAS, the B:C ratio were 0.98 and 0.87 where on the other hand B:C ratio of AAS farmers were 1.39 and 1.34 for the paddy crop during the year 2017 and 2018, respectively. The B:C ratio for the brinjal crop was 0.29 and 0.55 in the case of non AAS farmers and 0.54 and 0.84 for AAS farmers during the year 2017-18 and 2018-19, respectively, (Jagadeesh et al., 2010). Similar results were reported from the areas where farmers cultivated crops like rice, wheat, green gram, chilli and obtained more B:C ratio than farmers who did not use AAS (Gandhi et al., 2018; Ray et al., 2017; Maini and Rathore, 2011; Kumar et al., 2015).

It can be concluded that farmers saved Rs. 1940 and Rs. 2444 per ha for rice cultivation and Rs. 6685 and Rs. 6688 per ha for brinjal cultivation in a single season by following AAS (Mahato et al., 2022). The studies showed that the application of AAS based on realized and forecasting of weather parameters is a useful tool for increasing production and profit. The followers of AAB in the farming community who are utilizing the agro advisory bulletin for agricultural practices, reduce the cost of cultivation and increase the yield as well as profit.

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